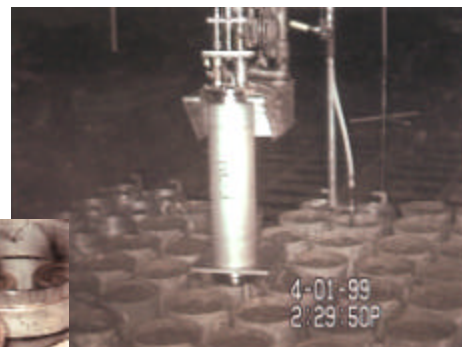




Consolidated Sludge Sampler

The Challenge

The Hanford Spent Nuclear Fuel (SNF) Project is preparing to move N Reactor fuel from the water-filled K Basins to interim dry storage. Intermingled with this uranium metal fuel is radioactive sludge on the floor and in the fuel canisters. The sludge consists of corrosion products from the fuel, from rusted racks and from canisters which hold the fuel. The actual composition varies widely from one part of the basins to another. It is anticipated that the sludge will have to undergo some form of treatment prior to being sent to storage. Treatment may be required for components in the sludge including the reactive unoxidized metallic uranium. Currently there is a need for large quantities of sampled sludge that must be collected in a manner that protects workers from dose exposure. The challenge is obtaining sufficiently large samples of sludge through grating which is suspended over water, twenty-one feet above the sludge-covered basin bottom.



Above: Sludge sampler mechanism collects samples from containers under water in K Basin. Inset: Underwater close-up view of spent fuel in canisters with sample probe inserted to gather sludge.

Current Approach

In the past, small samples of sludge have been retrieved for characterization of chemical and physical properties. Laboratory scale investigations of treatment technologies have also been performed. Initially, sludge was collected in grab sample bottles with little control over sample recovery. Subsequently, an apparatus called the “single pull” sampler was utilized to collect sludge. This device allowed the collection of sludge from a single basin location. Sludge was pumped into bottles above the surface of the pool. The amount of sludge collected was limited by the radiation hazard presented by the material and by the fact that, because of the pumping action, large amounts of extraneous water were added to the sludge. Typically, the amount of actual sludge recovered was a few hundred milliliters per sample.

Benefits and Features

- ◆ Sludge from several locations can be consolidated into one composite sample
- ◆ Sample containers remain underwater, providing improved worker protection shielding
- ◆ Large amounts (liters) of sludge can be collected in a single sample
- ◆ Minimal excess water is added to sludge during the collection process

New Technology

The new consolidated sludge sampling apparatus accumulates the sludge in a container that remains underwater during operation, thereby allowing highly radioactive sludge to be collected in large amounts with no hazard to operators. The pump, which produces a necessary suction, resides underwater, reducing the need for several safety features that previously were added to ensure that accidental discharges of sludge did not occur near personnel. The ability to start and stop the operation during sludge collection is a feature that allows the movement of the collection wand to multiple basin locations while feeding a single sample container. A micron-sized filter was added to the exit port of each sample container. This allows excess water to escape while trapping sludge particles. The capability to back-flush the filter also exists.

The sludge sampling device has been deployed at the K-East Basin and has successfully collected samples ranging from two to three liters from both the basin floor and fuel storage canisters.

This technology provides worker safety (As-Low-As-Reasonably-Achievable – ALARA) benefits and enables the collection of larger sludge quantities at a reduced cost.

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